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Gender, Assets, and Urban Water Insecurity:

A Qualitative Study from Baguio City, the Philippines

Lisa Reyes Mason
Center for Social Development

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Abstract: *This paper examines the role of gender and assets in vulnerability and adaptation to urban water insecurity in Baguio City, the Philippines. Exploratory in nature, findings are based on 15 in-depth interviews with women and men in three Baguio City neighborhoods. To cope with water insecurity, families manage "water portfolios" of different sources, which may vary seasonally or more frequently. Gender and asset dimensions of managing and securing these portfolios are explored, and implications for future research are discussed.*

Key words: *water, urban, gender, assets, climate change, Philippines*

Introduction

Water insecurity affects over one billion people worldwide, with numerous consequences (Biswas, 2006; UNDP, 2006). Between 2000 and 2020, at least 32 million people will have died from preventable water-related disease (Gleick, 2004). As people spend time collecting and waiting for water, their income potential decreases (Aiga & Umenai, 2002; Wutich, 2009). Water-related conflict at the local level also occurs, partly due to unequal water distribution and access (Allouche, 2011).

In many countries, such as the Philippines, water insecurity is of growing concern due to changing trends in seasonal rainfall variation and drought (Muller, 2007; Schneider et al., 2007; Yumul, Dimalanta, Servando, & Hilario, 2010; Yusuf & Francisco, 2009). In urban areas, the impact of these trends can be aggravated by urban migration, environmental pollution, and poor infrastructure for water treatment and delivery (Biswas, 2006; Pimentel et al., 2007).

While technical solutions to urban water insecurity are essential (e.g., improving infrastructure), policies that address the underlying social, economic, and political determinants of the problem are also needed, perhaps most urgently in developing countries, where technical solutions are often fiscally constrained (Asian Development Bank, 2006). Improved understanding of the social dimensions of urban water insecurity can inform such policies.

To generate this understanding, gender and assets are useful analytic concepts, yet little studied in urban water scholarship to date (Demetriades & Esplen, 2010; Moser & Satterthwaite, 2010; Ray, 2007; Wutich, 2009). This study thus advances knowledge by using qualitative methods to explore the question:

> How do gender and assets relate to vulnerability and adaptation to urban water insecurity in Baguio City, the Philippines?

Background

Gender, Assets, and Climate Change

This study draws on (1) gender and development and (2) social vulnerability scholarship. Gender refers to "socially produced differences between being feminine and masculine," (Holmes, 2007, p.2). Assets are forms of physical, financial, human, social, and natural capital, which people use to buffer crisis and advance their well-being (Moser, 2007; Sherraden, 1991).

Gender and assets matter for vulnerability and adaptation to climate change. Women are often considered more vulnerable to climate change outcomes than men, and gender roles and relations are increasingly studied as explanatory factors (Demetriades & Esplen, 2010; Denton, 2002; MacGregor, 2009). Assets, meanwhile, are known to protect people from vulnerabilities of various kinds by providing resources for short-term coping and long-term adaptation (Blaikie, Cannon, Davis, & Wisner, 1994; Drèze & Sen, 1989; Moser, 1998; Prowse & Scott, 2008; Ribot, 2010). But in what specific ways do gender and assets matter, for which climate change outcomes, and why?

A small but growing number of studies have examined relationships between gender, assets, and climate change (e.g., Ahmed & Fajber, 2009; Brown & Lapuyade, 2001; Buechler, 2009; Carter, Little, Mogues, & Negatu, 2007; Cruz-Torres, 2001; Dei, 1992; Eriksen, Brown, & Kelly, 2005; Molua, 2009; Wutich, 2009; Wutich & Ragsdale, 2008). Themes from this literature are gendered income diversification as a coping strategy, the role of gendered assets in vulnerability and adaptation, and the importance of examining gender's intersection with other variables of interest.

For example, on physical and financial capital, assets are gendered in ways that limit women's ability to cope with food shortage (Brown & Lapuyade, 2001) and protect homes from disaster (Molua, 2009). Human capital, such as education and training, can also be gendered and affect how women and men survive, cope with, and recover from climate hazards (Ahmed & Fajber, 2009; Buechler, 2009; Eriksen, Brown, & Kelly, 2005; Molua 2009). On social capital, child care networks help women pursue diversified incomes in the context of environmental change (Cruz-Torres, 2001).

While innovative in many ways, these studies have important limitations. First, few focus on specific climate change outcomes, and just two examine urban water insecurity (Wutich 2009; Wutich & Ragsdale, 2008). Instead, most examine broad climate phenomena such as flooding, drought, climate variability, or disasters generally. Studies also tend to discuss gender in broad terms, often without clarifying how gender is used analytically, other than to distinguish between all women and men or between female- and male-headed households. For the case of water insecurity, this limitation is particularly important to address, given that water access, needs, and use are shaped by gender relations in every society (Ray, 2007; Wallace & Coles, 2005), and that household structure is more complex that just female- or male-headship (Buvinić, 1983; Kabeer, 1994; Moser, 1993).

Understanding Water Insecurity

Analogous to food insecurity, water insecurity can be defined as the lack of access "by all people, at all times, to adequate water for an active and healthy lifestyle," (Wutich & Ragsdale, 2008, p. 2117). This definition includes water for basic (e.g., drinking, cooking, bathing, sanitation) and non-basic (e.g., washing dishes, laundry, gardening) needs.

Standard measures of water insecurity do not yet exist (Gleick, 2003; Hadley & Wutich, 2009). National measures often focus on household access to an improved water source for basic needs, where *improved source* means piped water into a dwelling or yard, a public tap or standpipe, a protected well or borehole, a protected spring, or rainwater; and *access* means 20 liters per person, per day, within 1 kilometer of the person's home (UNDP, 2006). While useful in some ways, such measures have a low benchmark for the amount of water required for basic needs (Gleick, 1998). They also do not consider water quality or water access in terms of affordability, regularity, or time spent procuring water (Bradley, 2004; Hadley & Wutich, 2009; Satterthwaite, 2003).

To better understand household water insecurity, this study approaches the concept as complex and multi-faceted, with dimensions of quantity, quality, affordability, physical access, and temporal access (Gleick, 1998; Hadley & Wutich, 2009; Nyong & Kanaroglou, 1999; Ray, 2007). Seasonal aspects of these dimensions are also considered, which have been little studied in urban water research to date (Wutich & Ragsdale, 2008). For this exploratory study, qualitative methods are used to probe the complex concept and phenomena of urban water insecurity, and how it relates to gender and assets.

Study Setting

Located in Southeast Asia, the Philippines has a population of 89 million, and an overall medium level of human development that varies substantially across and within regions (Philippine Human Development Network, 2009; UNDP, 2009). National estimates of access to an improved water source range from 70 to 85 percent, although this measure is limited for reasons discussed above (Gleick, 2009; National Statistics Office & ICF Macro, 2009).

Compared to many developing countries, the status of women in the Philippines is relatively high. Life expectancy, literacy rates, and education enrollment ratios for women exceed those for men (UNDP, 2009). Gender relations tend toward egalitarian (Eder, 2006). Gendered division of labor within and outside of the home, however, is still common (Illo & Pineda Ofreneo, 1999), and the ratio of female to male earned income is 0.61 (UNDP, 2007). Given these characteristics, the Philippines is an innovative setting for this study, as the broader gender, water, and development literature has often relied on scholarship in rural areas of countries with more traditional gender relations (Ray, 2007).

The study site, Baguio City, is located in the mountainous Cordillera Administrative Region in northern Philippines and has a total population of 302,000 (National Statistics Office, 2007). As much urban water scholarship has focused on megacities with populations of 10 million or more, research in mid-sized cities like Baguio City is also innovative and productive, as these cities are growing rapidly and already house one-quarter of the world's population (Biswas, 2006).

Baguio City's municipal water system is managed by the Baguio Water District (BWD), which reaches an estimated 50% of households through piped connections. Threats to water security include overpopulation, poorly financed and maintained infrastructure, environmental degradation, seasonal rainfall variation, and drought (Asian Development Bank, 2006). The area has a rainy season from May to October, and dry season from November to April.

BWD rations the municipal water supply year round. Homes in a given neighborhood, for example, may have a water schedule of three days per week, for four hours each day. During the dry season,

this schedule is often interrupted in unpredictable ways. Also, the quality of BWD water, while classified as an improved source, is suspect due to mining pollution, poorly maintained water treatment facilities, and aging delivery infrastructure (Asian Development Bank, 2006; Broad & Cavanagh, 1994).

Due in part to problematic supply and questionable quality of BWD water, Baguio City households often use other or supplemental water sources to meet their needs, including private delivery water (i.e., private companies that deliver water via water tank trucks), bottled/mineral water, protected springs, unprotected springs and creeks, and rainwater.

Methods

Sample Selection

The sample consists of 15 individuals who completed an in-depth interview for this study. To construct the sample, I conducted informal interviews with the Baguio City Health Officer, other Baguio City officials, neighborhood leaders, and local residents to identify possible study neighborhoods. I also reviewed profiles of neighborhood history, demographics, topography, social and economic concerns, and development plans, which are publicly available at the Baguio City Planning Office. For variation in neighborhood characteristics and water sources, I then selected the Dominican Hill, Irisan, and Hillside neighborhoods for this study. Each neighborhood is briefly described under Results.

After selecting the neighborhoods, I met with each neighborhood captain (the local elected official), to introduce the study and obtain permission to recruit participants in person. Assisted by a translator and key informants in each neighborhood, I used purposive sampling to obtain variation among participants by gender and household structure, income, and water sources. With the exception of one case (an adult daughter in an extended family), I interviewed the person considered most knowledgeable and/or responsible for water management in the household.

Interview Protocol

Interviews were conducted in person and in the participant's preferred language (Ilocano, Tagalog, or English), and lasted on average one hour. I conducted the interviews in March 2011, with translation assistance when interviews were in Ilocano or Tagalog. Each participant gave verbal consent to participate in the study prior to the interview. Participants also received a small incentive of dry goods (e.g., rice, sugar) at the end of the interview. Twelve of the interviews were recorded through notetaking, and three were audiotaped and transcribed.

Interviews used an open-ended topic guide with eight areas of inquiry: (1) household demographics; (2) household water sources and uses; (3) perceptions of water insecurity by source; (4) strategies for coping with water insecurity; (5) gender dimensions of water insecurity; (6) asset dimensions of water insecurity; (7) seasonal aspects of water sources, uses, and insecurity; and (8) ways to address household water insecurity.

Analysis

Analytic methods include study data review, memo production, and qualitative text analysis (Charmaz, 2006; Strauss & Corbin, 1998). First, I reviewed all field notes, interview notes, and transcripts. I then produced memos to record initial observations and themes emerging from the data, and to generate an initial interview coding scheme. Finally, I performed qualitative text analysis with NVIVO 8, coding all interview notes and transcripts, and looking for themes of similarity and difference across interviews.

Results

After describing the interview sample and study neighborhoods, this section presents three themes that emerged from qualitative text analysis:

1. Water portfolios and seasonal insecurity
2. Gender roles and relations in household water management
3. The role of physical, financial, and social capital in reducing water insecurity

Interview Sample

Study participants are from the Dominican Hill (N=5), Irisan (N=3), and Hillside (N=7) neighborhoods in Baguio City. Each neighborhood is described briefly below.

Dominican Hill (known officially as Dominican-Mirador) has an estimated population of 4,182. (Dominican-Mirador Barangay Council, 2010). The neighborhood income level is mixed. While originally settled by Baguio City "millionaires," Dominican Hill now houses many middle income and poor families, including numerous squatters. The neighborhood is considered one of Baguio City's most developed areas for electricity and paved roads. It is one of the least developed, however, for BWD piped connections due to its rocky, mountainous terrain (Dominican-Mirador Barangay Council, 2010). Households generally rely on private delivery water, bottled/mineral water, and rainwater to meet their water needs.

Irisan is Baguio City's largest neighborhoods, with a population of 18,827 (Irisan Barangay Council, 2010). This study recruited participants from one district within the neighborhood, where a city dumpsite is located. In this area, household income is also mixed, with many families scavenging from the dumpsite for their livelihood. In general, households rely on different combinations of BWD water, private delivery water, piped water from a nearby protected (but contaminated) spring, bottled/mineral water, and rainwater.

Hillside has an estimated population of 1,735, with families of all income levels (Hillside Barangay Council, 2010). Hillside is adjacent to one of Baguio City's watersheds, and about 20% of the neighborhood land is forested. Hillside also has two protected springs which are used by almost all residents, to varying degrees, and in varying combination with other water sources: BWD, private water delivery, bottled/mineral water, and rainwater.

Table 1. Sample Characteristics by Neighborhood

Characteristic	Dominican Hill (N=5)	Irisan (N=3)	Hillside (N=7)	All (N=15)
Gender				
Female	3	3	5	11
Male	2	0	2	4
Age				
Minimum	35	22	30	22
Maximum	44	40	60	60
Mean	39	31	46	41
Marital Status				
Single	1	0	2	3
Married, resident spouse	3	3	3	9
Married, non-resident spouse	1	0	2	3
HH Size				
Minimum	2	4	2	2
Maximum	7	7	12	12
Mean	5	6	6	6
Monthly HH Income, PhP (USD)				
Minimum	3,936 (90)	9,132 (210)	800 (18)	800 (18)
Maximum	60,000 (1,379)	13,000 (299)	80,000 (1,839)	80,000 (1,839)
Mean	19,594 (450)	10,422 (240)	19,050 (438)	17,506 (402)

Note: HH is household. Income conversion is $1 (USD or U.S. dollars) to ₱43.5 (PhP or Philippine pesos).

Sample characteristics by neighborhood are summarized in Table 1. Interviews were conducted with 11 women and 4 men. Participant age ranges from 22 to 60 years, with a mean of 41 years.

Participants are single (N=3), married with a resident spouse (N=9), or married with a non-resident spouse (N=3, i.e., the spouse has migrated for employment). Household size ranges from two to 12 members, with a mean of six. Eight study participants live in households comprised of a married couple with children. Other household forms are three cases of extended families living together; two cases of a married individual with children, and whose spouse is overseas; and two cases of single, male relatives living together.

Household income in this study ranges from ₱800 ($18) to ₱80,000 ($1,839) per month. Mean monthly household income is ₱17,506 ($402), or on average ₱2,918 ($67) per capita, per month.

Water Portfolios and Seasonal Insecurity

Multiple Sources, Particular Uses

Households in this study use a variety of "water portfolios" to meet their needs (Table 2), often adjusting these portfolios seasonally or more frequently, in response to changing individual, household, neighborhood, municipal, or environmental conditions.

In Dominican Hill, most participants rely primarily on private delivery water for cooking, bathing, sanitation, and cleaning during the dry season. BWD connections are rare in the neighborhood, given the rocky terrain. Although some participants have very low incomes, they prioritize money for water because they "have to." Several participants describe choosing to spend money on water

Table 2. All Household Water Sources, by Neighborhood (N=15)

Water Source	Dominican Hill (N=5)	Irisan (N=3)	Hillside (N=7)	All (N=15)
Baguio Water District (BWD)	1	1	2	4
Private delivery water	5	2	1	8
Bottled/mineral water	5	2	3	10
Protected spring	0	1	6	7
Unprotected spring or creek	0	0	1	1
Rainwater	4	3	7	14

instead of food for themselves and their families, in part because they have developed coping strategies to meet their other needs. As one female participant, in a low-income household, states:

> Do I have to choose between water and food or other things? Every time! I choose water first. If there is no gas, I can use wood. For food, I can use my food stock {from selling at school}…Even if I don't have money for water, I have to find it.

A male participant who buys private delivery water also notes:

> If I'm on a tight budget, water is the priority, because we can get food on credit from the *sari-sari* store. But with water, you cannot get a loan from the company. You have to pay up front. Water comes first.

In Irisan, the three study participants have very different water portfolios from each other. One relies primarily on private delivery water, another on BWD, and the third on private delivery water and water piped from a protected spring. While the spring was protected 10 years ago to provide the area with a safe water supply, water quality is highly suspect due to contamination from the city dumpsite. This third participant thus deliberately allocates water sources to specific uses: bottled/mineral water for drinking, private delivery water for cooking, and piped spring water for all other needs.

In Hillside, many participants benefit from a protected spring that is considered a safe source, where participants collect water in buckets or jugs for drinking, cooking, bathing, cleaning, and sanitation. While Hillside participants of all incomes use the spring, some use it as a primary source while others use it for emergencies. Two Hillside participants also rely heavily on BWD water ("Bawadi"), and both complain about decreasing supply over time. One of these participants, a long-time Hillside resident, recalls:

> You have to understand, when I came here, nobody else had Bawadi. So I had water every day, since I was the only one connected to the water district, and the pumping station is very near. The water pressure was so strong that our faucets used to swirl up in the air because of the pressure. And then people started connecting to the water district. We still had water every day so to speak, but intermittent operation already….And then, after a few years, it became Tuesdays, Thursdays, and Saturdays, but still the whole day.

On the current state of BWD water as irregular and unpredictable, she also describes:

> …our water supply…is *scheduled* for three times a week, not necessarily *comes* three times a week…from 2:30 p.m. until 6:00 or 7:00 p.m. But it doesn't always come….when it's raining, then usually it comes. When the pump, the water station breaks down, or there is rotating brownouts, which we have during the summer, and then if the rotating brownouts occurs on Tuesdays, Thursdays, and Saturdays, we don't have water.
>
> For summer, it would be a good week if we got even water once a week….If I get to fill {my tank} up full, even one day, then trying to, among us, conserving water, we're able to manage. But that means not flushing the toilet every time you go to the toilet, you know, and bathing with maybe one pail of water, and not every day.

Like the participant above, all other study participants describe numerous ways in which they "maximize" or conserve water, including: bathe less, wash dishes once per day, wash laundry once per week, reuse dish or laundry water for other purposes (e.g., sanitation, backyard gardening), collect used bath water in a basin for other purposes, and use rainwater for "everything other than drinking."

For drinking water, almost all participants report purchasing bottled/mineral water or fetching water from a protected spring. Only two participants report drinking BWD water directly or only if boiled, and only one reports drinking private delivery water, only if boiled and when he cannot afford bottled/mineral water. While many participants said they "had not heard" of recent illness from consuming BWD or private delivery water, they seem suspect of the water quality. They observe that BWD water in particular is "yellow" or "rusty." One female participant observes:

> … it's dirty. There's soil in it. That's why we don't drink it….because even the pipes will be broken any day, because of the acid in the pipeline. So how much more to the people...if they put it inside their body?

Perceptions of water quality relate to the affordability dimension of water insecurity (i.e., household water expenditures), as most study participants who do not have physical access to a protected spring, choose to buy bottled/mineral water on a regular basis instead. Depending on household size, finances, and water conservation strategies, participants report buying from one to five 5-gallon water jugs per week. In most cases, this water is used just for drinking. Some higher income participants, however, also use this source for cooking certain foods such as soups and stews.

This preference for prioritizing bottled/mineral water purchase is one reason that household water expenses can, in some cases, reach as high as 25.6% of monthly household income (Table 3), as bottled/mineral water is much more expensive per unit than BWD or private delivery water.

Table 3. Monthly Water Expense as Percentage of Monthly Household Income, by Neighborhood and Season

Monthly Water Expense	Dominican Hill (N=5)	Irisan (N=3)	Hillside (N=7)	All (N=15)
Rainy Season Expense (% of Income)				
Minimum	2.2	0.6	0.0	0.0
Maximum	25.6	7.2	21.3	25.6
Mean	8.1	4.3	4.8	5.8
Dry Season Expense (% of Income)				
Minimum	2.9	0.6	0.0	0.0
Maximum	25.6	10.5	21.3	25.6
Mean	9.8	6.0	4.4	6.6

Seasonal Changes in Water Portfolios and Insecurity

For most study participants, the rainy season brings an abundance of water, and households often change which water source they use for which purpose. While many households use BWD or private delivery water for bathing, sanitation, washing dishes, and laundry during the dry season, these households substitute rainwater for such use during the rainy season. Some also substitute rainwater for their usual cooking water source.

As a result, dry season insecurities related to quantity, affordability, and temporal access often decrease during the rainy season, as families have not only more water, but fewer water expenditures (for BWD or private water), and more predictable water supply. Participants who rely on BWD during the dry season decrease their consumption to the minimum required amount, or no longer need to purchase supplemental private water delivery, resulting in one-third to one-half decrease in BWD and private delivery costs between seasons. Similarly, many participants who rely primarily on private delivery water during the dry season report decreasing the frequency of their orders from once or twice weekly, to once or twice monthly, again resulting in some seasonal decrease in water costs. For families that rely primarily on Hillside's protected spring, physical access to water is improved by collecting rainwater at home, resulting in less frequent trips to the spring and less time and physical effort carrying water back and forth.

Not surprisingly, the increase in water supply during the rainy season is generally welcomed by participants in this study. As one male participant, who lives in a squatter settlement, said:

> When it's rainy, we are "rich in water" because we collect rainwater from the roof. We fill up everything that we can to catch water.

Similarly, a female participant, who is married and responsible for most domestic responsibilities in her home, described:

> In the rainy season, we have a good life. We can do anything we want. We can even clean our cement floors, our chairs. We wash everything….In the dry season, there's limited water. You can't do whatever you want. We have to be very thrifty with water. With chairs and floors, we just wipe with a wet cloth. The C.R. {bathroom} smells bad because we are using laundry water. But you have to live with that. During rainy season, at least the C.R. has clean water.

Gender Roles and Relations

Gender and Portfolio Management

Among married households in this study, in which the spouse resides in the home, the wife is considered the person responsible for managing the household water portfolio. This is consistent with the gendered division of household labor in many Philippine families, as mentioned above (Illo & Pineda Ofreneo, 1999).

Married female participants describe several ways in which they manage water portfolios, from regularly checking on the household supply of various sources, to reminding their husbands to place water delivery orders, to deliberately performing certain domestic tasks themselves (i.e., not letting other household members perform them) because they are the ones who "know how to maximize water." In some cases, women describe these responsibilities in terms of caring for their children, such as the following participant:

> In our family, it's always me. He's more on the financial end. I'm always the one who sees to it that we have enough. We have many kids, so water is very important to us. Especially drinking water. I always make sure there's enough in reserve.

Married women also tend to be the ones to stay home and wait for private delivery water or BWD to arrive, which is in part due to (and potentially a cause of) different labor market participation between these women and their spouses. In some cases, however, women negotiate with other women to secure their water delivery, such as the following individual:

> Someone needs to be home, yes, from each family when water is delivered. Usually this is the woman. If I can't be home because I'm selling, then I ask my neighbor to do my part, to make sure my drum gets filled. Then, next time, I'll be the one to stay home if she needs to go out when delivery comes.

When a wife does not reside in the home, or two male relatives live together, the men themselves take on water portfolio management by default.

Money for Purchasing Water

In this study, most household income comes from men—namely, male study participants or the male spouses or extended relatives of female study participants. While it is men's income that seems to be used for water purchases, women in married couples are considered the money managers, responsible for budgeting for all household needs including water.

Several married female participants describe how their husbands "give all" their salary to their wives, keeping an "allowance" for themselves for transportation and other personal use. Women are then expected to manage the salary and make it last. As previously described, women in lower income families must often choose between spending on water and other necessities, such as food. In general, women do not discuss such daily purchases with their husbands; they make the decisions themselves.

One male participant however, whose wife works overseas and who thus is responsible for water portfolio management, comments:

> If my wife were here, I would still be the one to decide these things, because I am the head of the family.

Carrying Water

In this study, physically carrying water is one water management role that seems reserved for men. Men are routinely identified as the carriers of 5-gallon jugs of bottled/mineral water, and the primary carriers of buckets of water from springs. These men may be husbands, sons, nephews, and other relatives who carry water voluntarily (i.e., uncompensated, but often at the request of women who manage the household water portfolio), or even neighbors who are paid for transporting water back and forth.

The most common explanation for why men carry water more frequently than women is that "it is harder for women," especially if water needs to be carried up hill. While the *sari-sari* stores that sell bottled/mineral water are usually no more than a 5-10 minute walk from female participants' homes, male spouses are often asked to carry 5-gallon jugs back, for example, on their way home or after returning from work.

For spring water, all household members are expected to carry at least a small container or one bucket back from the spring if, for example, they go to the spring to bathe. So called "pitching" of water to fill a drum back at the house, however, tends to be a male responsibility. On this, one participant expressed concern for her daughters' physical safety, if water needed to be carried back from the spring at night.

Asset Types and Accumulation: Physical, Financial, and Social Capital

In this study, participants describe several types of physical, financial, and social capital that are relevant for household water portfolio management and water insecurity reduction. Table 4 summarizes each asset mentioned, its level of ownership, and its role in helping families address their water insecurity.

As the summary suggests, several forms of physical capital can help households obtain, store, and more readily use water, from all potential water sources. Further, both physical and financial capital can interact with social capital in interesting ways, to address household water security needs.

For example, some participants must order private delivery water with a group of other families (social capital), providing a critical mass for the delivery company to sell them one tank of water. Since purchasing one tank is beyond the means of any particular family in the group, the families pool their money so that each receives 1-3 drums of water per order. To store the water, however, participants or households must have their own drums (physical capital), acquired either through savings (financial capital) or through a neighbor or employer (social capital). In some cases, hoses (physical capital) are also needed to connect the delivery truck to the drums, if the group lives too far from a main road for the truck's hose to reach the drums. Individual families then use either buckets or hoses (physical capital) to transport water from the drums to their homes.

Table 4. Assets Relevant for Water Insecurity

Asset	Ownership	Function(s)
Physical Capital		
Cell phone	Private	Order private delivery water Call BWD to complain about irregular or insufficient supply
Modern stove	Private	More easily boil water than with traditional stove
Bucket, other small container	Private	Store private delivery water, when drum needed for rainwater collection Store drinking water separate from other water Store cooking water separate from other water Transport water from spring to home
Hose	Private	Connect from spring/creek to home Connect from water delivery truck to drum/home Connect from drum to home Connect from neighbor's roof to own drum Connect from neighbor's BWD to own drum Connect rainfall collection system to water tank
	Shared	Connect from water delivery truck to drum/home
Drum	Private	Receive and store private delivery water Collect and store rainwater
Water tank	Private	Receive and store private delivery water Receive and store BWD water Collect and store rainwater
	Communal	Receive and store private delivery water
Pipe connection	Private	Receive, store, and easily use BWD water Receive, store, and easily use spring water
Home	Private	Motivate saving for BWD connection, since home is permanent
Wall	Communal	Further protect spring from creek flooding, typhoon damage
Financial Capital		
Savings	Private	Purchase specific form(s) of physical capital needed for water ordering, collection, storage, and use: cell phone, modern stove, bucket, other small container, hose, drum, water tank, pipe connection, home Contribute to community collection for spring protection
Social Capital		
Relations w/neighbors	Private	Provide connection to BWD water via hose Provide critical mass for ordering private delivery water as a group Lend money for purchasing private delivery water Lend or give water Lend or give drums or tanks Provide employment by paying for carrying water Provide motivation to contribute to community collection for spring protection
Relations w/employers	Private	Lend or give drums or tanks

Note: Private means owned by one individual or household. Shared means jointly owned by two or more households. Communal means owned by a community association or considered communal property.

Not surprisingly, acquiring physical assets often requires savings, a form of financial capital. While prices vary, participants provided sample costs of key physical assets at ₱260 ($6) for a 10-meter hose, ₱600 ($14) for one drum (standard size, 55-gallon), ₱12,000 ($276) for one tank (varying size, typically holds 10 to 12 drums), and ₱15,000 ($345) for a BWD piped connection.

Since monthly household income in this study ranges from ₱800 ($18) to ₱80,000 ($1,839; see Table 1), saving for an asset such as a hose can require one-third of a poor household's monthly income. For some families, purchasing a drum—crucial for water collection and storage for most participants in this study—can consume almost an entire month's income. As several families already report having to choose between daily water and food expenses, saving for assets that would help reduce water insecurity seems challenging at best. Indeed, participants in this study describe a range of savings periods for different assets, from paying outright, to saving for weeks or years to purchase a hose, drum, or tank.

Finally, the gendered nature of income among households in this study may also relate to gendered decisions about asset purchase. While married women report making everyday decisions about water purchases independently, they also report having to discuss larger water-related asset purchases with their husbands, asking or encouraging them to save for a particular purchase that would alleviate household water insecurity or the woman's own role in portfolio management. The practice of such joint discussion and decision-making is not itself surprising, particularly since men's income in this study would be the primary source of savings. Rather, the point calls for further research into how women and men may bargain over saving for water-related asset purchases, instead of using income or savings for other individual or household needs or preferences.

Discussion and Future Research

This study aims to shed new light on how gender and assets relate to urban water insecurity in mid-sized cities like Baguio City, the Philippines. While the study's small sample size and purposive sampling do not permit generalization to the study neighborhoods or Baguio City at large, findings do suggest that individuals and households in this study manage complex water portfolios. On a daily basis, participants make critical decisions about water collection, purchase, allocation, and consumption in response to changing individual, household, and broader contextual factors.

While survey-based, nationwide measures of access to an improved source of water are essential for assessing some basic human right and public health aspects of water security (Gleick, 1998; UNDP, 2006), such measures cannot capture the complexity of water sources, uses, and decisions that individuals and households regularly manage (Satterthwaite, 2003). Indeed, while all participants in this study had some access to a water source that national measures would consider improved (BWD, a protected spring, or rainfall), most chose to purchase a non-improved source for their drinking water (bottled/mineral water), due in part to concerns about water quality.

Often, female spouses are responsible for managing water portfolios—ensuring that households have enough water from particular sources based on safety, affordability, and accessibility. Responsibility for portfolio management, however, seems to depend on overall household structure. While calls for integrating gender into climate change research often, perhaps understandably, default to calls for greater recognition of women's voice and experience, this study highlights the importance of understanding both women's and men's water-related needs, roles, and

responsibilities, as gendered similarities and differences may be informative for policy and program development.

On assets, this study identifies specific forms of physical, financial, and social capital that seem to matter for reducing vulnerability and increasing capacity to adapt to water insecurity in the study neighborhoods. In addition, the study hints at possible gendering of assets, as most household income (the source for financial savings and physical asset acquisition) here comes from male employment. Assets and gendered assets for water insecurity are areas ripe for more research, given the potential public policy role in strengthening and addressing inequalities in asset ownership and distribution.

Additional qualitative and quantitative research on the complexity of urban water insecurity—informed by a multi-faceted concept as in this study, and its relation to potentially key factors such as gender and assets—can further our understanding of this critical climate change outcome in developing countries. Some promising questions for future research include:

1. How do gender and assets relate to urban water insecurity both among and within households?
2. In what ways are water-related assets gendered, and how does this matter for urban water insecurity?
3. How can public policies support those assets identified as critical to vulnerability and adaptation to urban water insecurity?
4. When water expenses decrease seasonally, can and will families capture these savings for other productive assets that strengthen their adaptive capacity?

Examining critical questions like these is necessary, if we are to develop and implement vulnerability reduction and adaptation policies that are responsive to people's lived experience of water insecurity and effective at helping them thrive under changing water and climate conditions.

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